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UNITED STATES PATENT AND TRADEMARK OFFICE

BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:	Huebner et al.
Appl. Serial No.:	10/005,717
Filed:	11/08/2001
For:	Sensing Device and Method Using Photo-Induced Charge Movements
Art Unit:	1743
Examiner:	Snay

APPEAL BRIEF

(1) Real Parties in Interest:

University of North Florida, by assignment from Huebner and Arrieta

(2) Related Appeals and Interferences:

None

(3) Status of Claims:

Claims 1 - 20: Rejected

(4) Status of Amendments:

None filed subsequent to final rejection. Earlier amendments were entered.

(5) Summary of Invention:

1. A method for detecting the presence of a target substance in a solution comprising the steps of:	Pg. 4, line 13 to Pg. 5, line 6; Pg. 19, line 19 to Pg. 22, line 6.
providing a sensing device to sense the photo-induced charge movements consisting of isometric change or the ejection of electrons, protons or OH^- ions	Pg. 8, lines 1-12.
and resulting from illumination of a dye which is in contact with said target substance;	Pg. 8, lines 1-3 and line 12 to Pg. 9, line 5.
placing said target substance in contact with said dye;	Pg. 9, lines 9-13.
illuminating said dye;	Pg. 9, line 19 to Pg. 10, line 1.
detecting and analyzing said photo-induced charge movements.	Pg. 10, lines 1-7.
2. The method of claim 1, further comprising the steps of:	
choosing a dye which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance.	Page 4, line 13 to Page 5, line 1; Page 6, line 17 to Page 7, line 1; Page 19, lines 18-20.

3. The method of claim 1, further comprising the step of adsorbing said dye onto a membrane.	Pg. 6, lines 10-12; Pg. 9, lines 5-7; Pg. 20, line 1.
4. The method of claim 1, further comprising the steps of:	
detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when not in contact with said target substance;	Pg. 9, lines 15-16; Pg. 20, lines 3-4.
comparing the results from illumination of said dye when not in contact with said target substance to the results obtained from illumination of said dye when in contact with said target substance.	Pg. 20, lines 9-11.
5. The method of claim 4, further comprising the steps of:	
successively detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with different concentrations of said target substance;	Pg. 20, lines 12-14.
comparing the results from illumination of said dye when in contact with said target substance to the results obtained from illumination of said dye when in contact with	Pg. 20, lines 15-18.

different concentrations of said target substance to determine the concentration of said target substance.

6. The method of claim 1, wherein said illumination step is performed with a duration of milliseconds or less.	Pg. 20, line 19.
7. The method of claim 1, wherein said illumination step is performed over a chosen wavelength range.	Pg. 20, line 20.
8. The method of claim 1, wherein said dye is formed as a self-assembling monolayer.	Pg. 6, line 14; Pg. 8, line 17.
9. The method of claim 3, wherein said dye is a first dye and said target substance is a first target substance, and further comprising the steps of:	Pg. 10, line 17 to Pg. 11, line 1; Pg. 21, lines 2-3 and lines 11-19.

providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said different target substance;

placing said different target substance in contact with said at least one different dye simultaneously with placing said first target substance in contact with said first dye;

illuminating said at least one different dye simultaneously with illuminating said first dye;

detecting and analyzing said photo-induced charge movements from said at least one different dye.

10. A method for detecting the presence of a target substance in a solution comprising the steps of:	Pg. 4, line 13 to Pg. 5, line 6; Pg. 19, line 19 to Pg. 22, line 6.
providing a sensing device to sense the photo-induced charge movements consisting of isometric change or the ejection of electrons, protons or OH^- ions and resulting from illumination of a dye which is in contact with said target substance;	Pg. 8, lines 1 to Pg. 9, line 5.
choosing a dye which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance;	Page 4, line 13 to Page 5, line 1; Page 6, line 17 to Page 7, line 1; Page 19, lines 18-20.
adsorbing said dye onto a membrane;	Pg. 6, lines 10-12; Pg. 9, lines 5-7; Pg. 20, line 1.
illuminating said dye;	Pg. 9, line 19 to Pg. 10, line 1.
detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when not in contact with said target substance to provide a baseline value;	Pg. 9, lines 15-16; Pg. 20, lines 3-4.
placing said target substance in solution in contact with said dye;	Pg. 9, lines 9-13.

illuminating said dye;	Pg. 9, line 19 to Pg. 10, line 1.
detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with said target substance;	Pg. 10, lines 1-7.
comparing the baseline value results from illumination of said dye when not in contact with said target substance to the results obtained from illumination of said dye when in contact with said target substance to determine if said target substance is present.	Pg. 20, lines 9-11.
11. The method of claim 10, further comprising the steps of:	
successively detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with different concentrations of said target substance to produce comparative concentration values;	Pg. 20, lines 12-14.
comparing the results from illumination of said dye when in contact with said target substance to the comparative concentration value results obtained from illumination of said dye when in contact with different concentrations of said target substance to determine the concentration of said target substance.	Pg. 20, lines 15-18.

12. The method of claim 10, wherein said illumination step is performed with a duration of milliseconds or less.	Pg. 20, line 19.
13. The method of claim 10, wherein said illumination step is performed over a chosen wavelength range.	Pg. 20, line 20.
14. The method of claim 10, wherein said dye is formed as a self-assembling monolayer.	Pg. 6, line 14; Pg. 8, line 17.
15. The method of claim 10, wherein said dye is a first dye and said target substance is a first target substance, further comprising the steps of: providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with a different target substance; placing said different target substance in contact with said at least one different dye simultaneously with placing said first target substance in contact with said first dye;	Pg. 10, line 17 to Pg. 11, line 1; Pg. 21, lines 2-3 and lines 11-19.

illuminating said at least one different dye simultaneously with illuminating said first dye;	
detecting and analyzing said photo-induced charge movements from said at least one different dye.	
16. The method of claim 10, wherein said dye is a first dye and said target substance is a first target substance, further comprising the steps of:	Pg. 21, lines 2-3
successively detecting and analyzing the photo-induced charge movements resulting from illumination of said first dye when in contact with different concentrations of said first target substance to produce comparative concentration values;	Pg. 201 lines 4-6.
comparing the results from illumination of said first dye when in contact with said first target substance to the comparative concentration value results obtained from illumination of said first dye when in contact with different concentrations of said first target substance to determine the concentration of said first target substance	Pg. 21, lines 7-10.
providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and	Pg. 21, lines 11-14.

which produces a different amount of photo-induced charge movements upon illumination when in contact with a different target substance;	
placing said different target substance in contact with said at least one different dye simultaneously with placing said first target substance in contact with said first dye;	Pg. 21, lines 15-16.
illuminating said at least one different dye simultaneously with illuminating said first dye;	Pg. 21, line 17.
detecting and analyzing said photo-induced charge movements from said at least one different dye;	Pg. 21, lines 18-19.
successively detecting and analyzing the photo-induced charge movements resulting from illumination of said at least one different dye when in contact with different concentrations of said different target substance to produce comparative concentration values;	Pg. 21, line 20 to Pg. 22, line 2.
comparing the results from illumination of said at least one different dye when in contact with said different target substance to the comparative concentration value results obtained from illumination of said at lest one different dye when in contact with different concentrations of said different target substance to determine the concentration of said different target substance.	Pg. 22, lines 3-6.

17. An apparatus for detecting the presence and concentration of a target substance in a solution through differences in photo-induced charge movements between a control solution and a target solution containing the target substance, wherein a dye is utilized which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance, the apparatus comprising:	Pg. 4, line 13 to Pg. 5, line 6; Pg. 6, line 10 to Pg. 7, line 1.
a light source for illumination;	Pg. 8, lines 2-3.
a container to receive a target solution containing a target substance;	Pg. 9, lines 10-11; Fig. 8A
a membrane disposed within said container;	Pg. 4, line 14; Pg/ 6, lines 12-17; Pg. 8, line 17; Fig. 3; Fig. 8A
a dye adsorbed onto said membrane which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance, said dye being in contact with said target solution;	Page 4, line 13 to Page 5, line 1; Page 6, lines 10-12 and line 17 to Page 7, line 1; Pg. 9, lines 5-7.

an electrometer in electrical communication with said membrane to detect said photo-induced charge movements relative to said membrane and to generate a signal for analysis;	Pg. 8, lines 3-6 and 11; Pg. 9, line 19 to Pg. 10, line 5; Fig. 3.
means to analyze said signal to determine the presence and concentration of said target substance.	Pg. 8, line 2 and lines 6-8; Pg. 10, lines 5-7.
18. The apparatus of claim 17, wherein said light source is chosen from the group of light sources consisting of lasers, stroboscopes and LEDs.	Pg. 8, lines 2-3.
19. The apparatus of claim 17, wherein said membrane is self-assembled monolayer.	Pg. 6, line 14; Pg. 8, line 17.
20. The apparatus of claim 17, where said analyzer means is an oscilloscope.	Pg. 8, line 2 and lines 6-8; Pg. 10, lines 5-7.

(6) Issues:

I. Whether Claims 1-3, 7 and 9 are unpatentable under 35 U.S.C. 102(b) as being anticipated by Clark et al. '868.

II. Whether claims 4-6 and 10-20 are unpatentable under 35 U.S.C. 103(a) over Clark et al. '868.

(7) Grouping of Claims:

Group I (Claims 1-3, 7 and 9): Applicant states that the claims of the group do not stand or fall together.

Group II (Claims 4-6 and 10-20): Applicant states that the claims of the group do not stand or fall together.

(8) Argument:

I. Whether Claims 1-3, 7 and 9 are unpatentable under 35 U.S.C. 102(b) as being anticipated by Clark et al. '868.

The Examiner has rejected these claims under Section 102(a) as anticipated by Clarke et al. As previously argued in the Amendment and Response filed 04/09/2004 and in the Amendment and Response filed with the RCE Request on 01/07/2005, it is submitted that Clarke et al. does not "describe" the invention under Section 102(a). Simply put, it is submitted that Clarke et al. does not meet the minimum requirements for maintaining a rejection based on anticipation, as all of the essential elements set forth in the claim are not identically set forth in Greenhalgh. Herman v. William Brooks Shoe Co., 54 USPQ2d 1046 (S.D. N.Y. 2000); Gechter v. Davidson, 116 F.3rd 1454, 1457, 43 USPQ2d, 1030, 1032 (Fed. Cir. 1997).

Claim 1:

Independent claim 1 requires (in pertinent part) "providing a sensing device to sense the photo-induced charge movements consisting of isometric change or the ejection of electrons, protons or OH^- ions and resulting from illumination of a dye which is in contact with said target substance" and "detecting and analyzing said photo-induced charge movements."

The method of Clarke et al. is an analytical method that senses and detects heat, it is not a method that senses and detects photo-induced charge movements. Attention is drawn to the following passages, among others, from Clarke et al.:

> Abstract (lines 8-9): "light absorption in the reagent regions is detected as microscopic heating at the transducer surface"
>
> Specification (col. 2, lines 35-36): "light absorption in the reagent can be detected through localized heat generation"
>
> (col. 3, lines 6-9): "monitoring said transducer output signal to derive through determination of heat generation at said surface a measure of absorption"
>
> (col. 4, lines 32-33): "heating is sensed by the transducer"

Thus, Clarke et al. is sensing and detecting radiative heat, not photo-induced charge movements resulting from illumination of a dye in contact with a target substance. The term "photo-induced charge movements" has meaning in the art, to wit, that the charge movements are produced in direct result from impingement of light. The Examiner appears to be arguing that charge movements created by the thermo-electric transducer of Clarke et al. are photo-induced charge movements, since light impingement initiates the production of heat. The charge movements of Clarke et al. would be equivalently designated to be "thermal-induced charge movements", since it is the presence of thermal energy that directly produces the charge movements. In other words, one deciding to turn on a light bulb does not produce "brain wave-induced" light simply because there is a chain of events - the brain waves activate muscles that flip a switch that delivers electricity to the bulb filament that heats up to produce light. And the eye that sees the light is not sensing or detecting the charge movements that create the heat that produces the light, since the eye can only detect and sense the light, which may have been produced by electrical current, oxidation, chemical reaction, etc.

Claim 2:

Claim 2, dependent on claim 1, requires "choosing a dye which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance." Clarke et al. does not describe or identically set forth this element as required for a Section 102(a) rejection.

The dyes (reagents) of Clarke et al. are chosen solely on the basis of their heat producing characteristics when in the presence of the target substance. The type of reagent chosen varies widely depending on the particular analytical procedure undertaken (col. 4, lines 42-43). A reagent may be chosen that changes color on chelation/binding or ions (col. 4, lines 43-45). A reagent may be chosen that produces a chemical substance (col. 4, lines 45-49). The reagent may respond as an antigen or antibody (col. 4, lines 49-52). It does not matter in the method of Clarke et al. whether a suitable reagent produces a different amount of photo-induced charge movements upon illumination when in contact with the target substance.

This claim is patentably distinct from Claims 1, 3, 7 and 9 because it is narrower by requiring a particular type of dye to be chosen in the performance of the method.

Claim 3:

Claim 3, dependent on claim 1, requires "adsorbing said dye onto a membrane." Clarke et al. does not describe or identically set forth this element as required for a Section 102(a) rejection.

In the device of Clarke et al., the dye (reagent) is deposited upon the upper electrode rather than upon the PVDF film (col. 4, lines 3-9). Thus, even if the reagent is applied by adsorption methods, which are not specifically set forth in Clarke et al., it is not <u>adsorbed</u> onto a membrane (defined in Applicant's specification at page 6, lines 12-13 to comprise any thin dielectric film, such as for example Teflon, cellulose and polyvinylalcohol). The Examiner states in the Final Office Action of 03/11/2005 (page 3, section 7) that "the reagent is adsorbed onto the polymer by means of an intermediate electrode". This can only be true if the definition of "adsorbed" is ignored completely. In Clarke et al., the reagent is (possibly) adsorbed on the metal electrode, which are coatings applied to the PVDF film. The reagents are not adsorbed onto the PVDF film.

This claim is patentably distinct from Claims 1, 2, 7 and 9 because it is narrower by requiring a particular methodology for applying the dye and that the dye be deposited by adsorption onto the membrane.

<u>Claim 7:</u>

The arguments for claim 7, dependent on claim 1, are the same as presented above for claim 1.

<u>Claim 9:</u>

Claim 9, dependent on claim 3, requires (in pertinent part) "providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said different target substance" and "detecting and analyzing said photo-induced charge movements from said at least one different dye." Clarke et al. does not describe or identically set forth this element as required for a Section 102(a) rejection.

As to the elements set forth in claims 1 and 3, upon which this claims depends, the arguments presented above are repeated. This claim further requires a different dye to be adsorbed onto the membrane, the dye producing a different amount of photo-induced charge movements upon illumination.

This claim is patentably distinct from Claims 1, 2, 3 and 7 because it is narrower by requiring a particular methodology for a second dye.

II. Whether claims 4-6 and 10-20 are unpatentable under 35 U.S.C. 103(a) over Clark et al. '868.

A rejection under Section 103(a) requires that the combined prior art references teach or suggest all the claim limitations (MPEP 706.02(j), further based on the requirements of Graham v. John Deere, 383 U.S. 1, 148 459 (1966) and MPEP 2141-2144.9).

Claim 4:

Claim 4, dependent on claim 1, requires (in pertinent part) "detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when not in contact with said target substance" and "comparing the results from illumination of said dye when not in contact with said target substance to the results obtained from illumination of said dye when in contact with said target substance."

As previously argued in claim 1, the phrase "photo-induced charge movements" has a particular definition in the art, and the Examiner has not provided any prior art in support of the rejection, relying instead on statements that the method steps are well known in the art. It is

submitted that the particular method steps added in claim 4 are not so well known, as evidenced by the lack of prior art.

This claim is patentably distinct from Claims 5, 6 and 10-20 because it is narrower by requiring a particular methodology for establishing a control result.

Claim 5:

Claim 5, dependent on claim 4, requires (in pertinent part) "successively detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with different concentrations of said target substance" and "comparing the results from illumination of said dye when in contact with said target substance to the results obtained from illumination of said dye when in contact with different concentrations of said target substance to determine the concentration of said target substance."

As previously argued in claim 1, the phrase "photo-induced charge movements" has a particular definition in the art, and the Examiner has not provided any prior art in support of the rejection, relying instead on statements that the method steps are well known in the art. It is submitted that the particular method steps added in claim 5 are not so well known, as evidenced by the lack of prior art.

This claim is patentably distinct from Claims 4, 6 and 10-20 because it is narrower by requiring a particular methodology for establishing the concentration of the target substance.

Claim 6:

Claim 6, dependent on claim 1, requires (impertinent part) that the illumination step be "performed with a duration of milliseconds or less."

As previously argued in claim 1, the phrase "photo-induced charge movements" has a particular definition in the art, and the Examiner has not provided any prior art in support of the rejection, relying instead on statements that the method steps are well known in the art. It is submitted that the particular method steps added in claim 6 are not so well known, as evidenced by the lack of prior art.

This claim is patentably distinct from Claims 4, 5 and 10-20 because it is narrower by requiring a particular methodology for limiting the light exposure time.

<u>Claim 10:</u>

Claim 10 is an independent method claim that requires (in pertinent part) "providing a sensing device to sense the photo-induced charge movements consisting of isometric change or the ejection of electrons, protons or OH^{-} ions", "choosing a dye which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance", "adsorbing said dye onto a membrane", "detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when not in contact with said target substance to provide a baseline value", "detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with said target substance" and "comparing the baseline

value results from illumination of said dye when not in contact with said target substance to the results obtained from illumination of said dye when in contact with said target substance to determine if said target substance is present."

The method of Clarke et al. is an analytical method that senses and detects heat, it is not a method that senses and detects photo-induced charge movements. Attention is drawn to the following passages, among others, from Clarke et al.:

> Abstract (lines 8-9): "light absorption in the reagent regions is detected as microscopic heating at the transducer surface"
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> Specification (col. 2, lines 35-36): "light absorption in the reagent can be detected through localized heat generation"
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> (col. 3, lines 6-9): "monitoring said transducer output signal to derive through determination of heat generation at said surface a measure of absorption"
>
> (col. 4, lines 32-33): "heating is sensed by the transducer"

Thus, Clarke et al. is sensing and detecting radiative heat, not photo-induced charge movements resulting from illumination of a dye in contact with a target substance. The term "photo-induced charge movements" has meaning in the art, to wit, that the charge movements are produced in direct result from impingement of light. The Examiner appears to be arguing that charge movements created by the thermo-electric transducer of Clarke et al. are photo-induced charge movements, since light impingement initiates the production of heat. The charge movements of Clarke et al. would be equivalently designated to be "thermal-induced charge movements", since it is the presence of thermal energy that directly produces the charge movements. In other words, one deciding to turn on a light bulb does not produce "brain wave-induced" light simply because there is a chain of events - the brain waves activate muscles that flip a switch that delivers electricity to the bulb filament that heats up to produce light. And the

eye that sees the light is not sensing or detecting the charge movements that create the heat that produces the light, since the eye can only detect and sense the light, which may have been produced by electrical current, oxidation, chemical reaction, etc.

The dyes (reagents) of Clarke et al. are chosen solely on the basis of their heat producing characteristics when in the presence of the target substance. The type of reagent chosen varies widely depending on the particular analytical procedure undertaken (col. 4, lines 42-43). A reagent may be chosen that changes color on chelation/binding or ions (col. 4, lines 43-45). A reagent may be chosen that produces a chemical substance (col. 4, lines 45-49). The reagent may respond as an antigen or antibody (col. 4, lines 49-52). It does not matter in the method of Clarke et al. whether a suitable reagent produces a different amount of photo-induced charge movements upon illumination when in contact with the target substance.

The Examiner has not provided any prior art in support of the rejection, relying instead on statements that the method steps are well known in the art. It is submitted that the particular method steps added in claim 10 are not so well known, as evidenced by the lack of prior art.

This claim is patentably distinct from Claims 4-6 and 11-20 because the combination of claims limitations are not found in the other claims.

Claim 11:

Claim 11, dependent on claim 10, requires (impertinent part) "successively detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with different concentrations of said target substance" and "comparing the results from

illumination of said dye when in contact with said target substance to the results obtained from illumination of said dye when in contact with different concentrations of said target substance to determine the concentration of said target substance."

As previously argued in claim 10, the phrase "photo-induced charge movements" has a particular definition in the art, and the Examiner has not provided any prior art in support of the rejection, relying instead on statements that the method steps are well known in the art. It is submitted that the particular method steps added in claim 11 are not so well known, as evidenced by the lack of prior art.

This claim is patentably distinct from Claims 4-6, 10 and 12-20 because it is narrower by requiring a particular methodology for establishing the concentration of the target substance.

<u>Claim 12:</u>

Claim 12, dependent on claim 10, requires (impertinent part) that the illumination step be "performed with a duration of milliseconds or less."

As previously argued in claim 10, the phrase "photo-induced charge movements" has a particular definition in the art, and the Examiner has not provided any prior art in support of the rejection, relying instead on statements that the method steps are well known in the art. It is submitted that the particular method steps added in claim 12 are not so well known, as evidenced by the lack of prior art.

This claim is patentably distinct from Claims 4-6, 10, 11 and 13-20 because it is narrower by requiring a particular methodology for limiting the light exposure time.

Claim 13:

The arguments for claim 13, dependent on claim 10, are the same as presented above for claim 10.

Claim 14:

Claim 14, dependent on claim 10, requires (in pertinent part) that the " dye is formed as a self-assembling monolayer."

The Examiner does not address this rejection at all. There is no teaching in Clarke et al. that suggests, motivates or makes obvious forming the dye as a self-assembling monolayer, and thus there is no basis for this rejection.

This claim is patentably distinct from Claims 4-6, 10-13 and 15-20 because it is narrower by requiring a particular methodology for forming the dye layer.

Claim 15:

Claim 15, dependent on claim 10, requires (in pertinent part) "providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said different target substance" and "detecting and analyzing said photo-induced charge movements from said at least one different dye."

As to the elements set forth in claims 10, upon which this claims depends, the arguments presented above are repeated. This claim further requires a different dye to be adsorbed onto the membrane, the dye producing a different amount of photo-induced charge movements upon illumination.

This claim is patentably distinct from Claims 4-6, 10-14 and 16-20 because it is narrower by requiring a particular methodology for multiple dyes.

Claim 16:

Claim 16, dependent on claim 10, requires (impertinent part) "successively detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with different concentrations of said target substance", "comparing the results from illumination of said dye when in contact with said target substance to the results obtained from illumination of said dye when in contact with different concentrations of said target substance to

determine the concentration of said target substance", "providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said different target substance" and "detecting and analyzing said photo-induced charge movements from said at least one different dye."

As previously argued in claim 10, the phrase "photo-induced charge movements" has a particular definition in the art, and the Examiner has not provided any prior art in support of the rejection, relying instead on statements that the method steps are well known in the art. It is submitted that the particular method steps added in claim 16 are not so well known, as evidenced by the lack of prior art.

This claim is patentably distinct from Claims 4-6, 10-15 and 17-20 because it is narrower by requiring a particular methodology for establishing the concentration of the target substance and for multiple dyes.

Claim 17:

Claim 17 is an independent apparatus claim for "an apparatus for detecting the presence and concentration of a target substance in a solution through differences in photo-induced charge movements between a control solution and a target solution containing the target substance, wherein a dye is utilized which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance", with the apparatus comprising (in pertinent part):

"a container to receive a target solution containing a target substance,"

"a membrane disposed within said container",

"a dye adsorbed onto said membrane which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance, said dye being in contact with said target solution", and

"an electrometer in electrical communication with said membrane to detect said photo-induced charge movements."

The apparatus of Clarke et al. is a horizontally disposed surface upon which drops of sample are deposited. There is no container to retain a solution, there is no membrane disposed within a container and there is no dye adsorbed onto a membrane. The dye (reagent) chosen by Clarke et al. is one that produces heat upon illumination, not one that produces photo-induced charge movements. There is no electrometer that detects the photo-induced charge movements, since any electrometer device in Clarke et al. detects regular charge movements produced by the

thermo-transducer. These arguments have been previously presented in relation to the method claims and are incorporated herein in this section.

There is nothing in Clarke et al., alone or in combination with the level of ordinary skill in the art, to suggest, motivate or teach the apparatus as claimed, absent hindsight from Applicant's disclosure. The Examiner states in the Office Action of 02/18/2004 (page 4, section 6) that it would be obvious to place Clarke et al.'s sensor device within a container to which a sample would be added. This is not obvious, given that the device of Clarke et al. is structured for use with individual drops of samples, and it is expressly stated to be an advantage that the apparatus works with small sample volumes (col. 2, lines 55-67).

This claim is patentably distinct from Claims 4-6, 10-16 and 18-20 because it involves an apparatus as opposed to a method.

Claim 18:

The arguments for claim 18, dependent on claim 17, are the same as presented above for claim 17.

Claim 19:

Claim 19, dependent upon claim 17, requires (in pertinent part) the membrane to be a "self-assembled monolayer."

The Examiner does not address this rejection at all. There is no teaching in Clarke et al. that suggests, motivates or makes obvious the membrane as a self-assembling monolayer, and thus there is no basis for this rejection.

This claim is patentably distinct from Claims 4-6, 10-18 and 20 because it is narrower by requiring a particular structure for the membrane.

Claim 20:

Claim 20, dependent upon claim 17, requires (in pertinent part) the analyzer means to be an oscilloscope.

The Examiner does not address this rejection at all. There is no teaching in Clarke et al. that suggests, motivates or makes obvious the use of an oscilloscope, and the use of an oscilloscope with the apparatus of Clarke et al. would not be functional.

This claim is patentably distinct from Claims 4-6 and 10-19 because it is narrower by requiring theuse of a particular analyzer device.

For the reasons set forth above, it is respectfully requested that the final rejection of the claims at issue be reversed in whole, and that the claims be passed for allowance and issue.

Respectfully submitted,

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Date

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(9) Appendix:

Claims:

1. A method for detecting the presence of a target substance in a solution comprising the steps of:

providing a sensing device to sense the photo-induced charge movements consisting of isometric change or the ejection of electrons, protons or OH^- ions and resulting from illumination of a dye which is in contact with said target substance;

placing said target substance in contact with said dye;

illuminating said dye;

detecting and analyzing said photo-induced charge movements.

2. The method of claim 1, further comprising the steps of:

choosing a dye which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance.

3. The method of claim 1, further comprising the step of adsorbing said dye onto a membrane.

4. The method of claim 1, further comprising the steps of:

detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when not in contact with said target substance;

comparing the results from illumination of said dye when not in contact with said target substance to the results obtained from illumination of said dye when in contact with said target substance.

5. The method of claim 4, further comprising the steps of:

successively detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with different concentrations of said target substance;

comparing the results from illumination of said dye when in contact with said target substance to the results obtained from illumination of said dye when in contact with different concentrations of said target substance to determine the concentration of said target substance.

6. The method of claim 1, wherein said illumination step is performed with a duration of milliseconds or less.

7. The method of claim 1, wherein said illumination step is performed over a chosen wavelength range.

8. The method of claim 1, wherein said dye is formed as a self-assembling monolayer.

9. The method of claim 3, wherein said dye is a first dye and said target substance is a first target substance, and further comprising the steps of:

providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-

induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said different target substance;

placing said different target substance in contact with said at least one different dye simultaneously with placing said first target substance in contact with said first dye;

illuminating said at least one different dye simultaneously with illuminating said first dye;

detecting and analyzing said photo-induced charge movements from said at least one different dye.

10. A method for detecting the presence of a target substance in a solution comprising the steps of:

providing a sensing device to sense the photo-induced charge movements consisting of isometric change or the ejection of electrons, protons or OH^- ions and resulting from illumination of a dye which is in contact with said target substance;

choosing a dye which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance;

adsorbing said dye onto a membrane;

illuminating said dye;

detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when not in contact with said target substance to provide a baseline value;

placing said target substance in solution in contact with said dye;

illuminating said dye;

detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with said target substance;

comparing the baseline value results from illumination of said dye when not in contact with said target substance to the results obtained from illumination of said dye when in contact with said target substance to determine if said target substance is present.

11. The method of claim 10, further comprising the steps of:

successively detecting and analyzing the photo-induced charge movements resulting from illumination of said dye when in contact with different concentrations of said target substance to produce comparative concentration values;

comparing the results from illumination of said dye when in contact with said target substance to the comparative concentration value results obtained from illumination of said dye when in contact with different concentrations of said target substance to determine the concentration of said target substance.

12. The method of claim 10, wherein said illumination step is performed with a duration of milliseconds or less.

13. The method of claim 10, wherein said illumination step is performed over a chosen wavelength range.

14. The method of claim 10, wherein said dye is formed as a self-assembling monolayer.

15. The method of claim 10, wherein said dye is a first dye and said target substance is a first target substance, further comprising the steps of:

providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with a different target substance;

placing said different target substance in contact with said at least one different dye simultaneously with placing said first target substance in contact with said first dye;

illuminating said at least one different dye simultaneously with illuminating said first dye;

detecting and analyzing said photo-induced charge movements from said at least one different dye.

16. The method of claim 10, wherein said dye is a first dye and said target substance is a first target substance, further comprising the steps of:

successively detecting and analyzing the photo-induced charge movements resulting from illumination of said first dye when in contact with different concentrations of said first target substance to produce comparative concentration values;

comparing the results from illumination of said first dye when in contact with said first target substance to the comparative concentration value results obtained from illumination of said first dye when in contact with different concentrations of said first target substance to determine the concentration of said first target substance

providing at least one different dye from said first dye and adsorbing said at least one different dye onto said membrane, wherein said at least one different dye produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with a different target substance;

placing said different target substance in contact with said at least one different dye simultaneously with placing said first target substance in contact with said first dye;

illuminating said at least one different dye simultaneously with illuminating said first dye;

detecting and analyzing said photo-induced charge movements from said at least one different dye;

successively detecting and analyzing the photo-induced charge movements resulting from illumination of said at least one different dye when in contact with different concentrations of said different target substance to produce comparative concentration values;

comparing the results from illumination of said at least one different dye when in contact with said different target substance to the comparative concentration value results obtained from illumination of said at lest one different dye when in contact with different concentrations of said different target substance to determine the concentration of said different target substance.

17. An apparatus for detecting the presence and concentration of a target substance in a solution through differences in photo-induced charge movements between a control solution and a target solution containing the target substance, wherein a dye is utilized which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance, the apparatus comprising:

a light source for illumination;

a container to receive a target solution containing a target substance;

a membrane disposed within said container;

a dye adsorbed onto said membrane which produces photo-induced charge movements upon illumination and which produces a different amount of photo-induced charge movements upon illumination when in contact with said target substance, said dye being in contact with said target solution;

an electrometer in electrical communication with said membrane to detect said photo-induced charge movements relative to said membrane and to generate a signal for analysis;

means to analyze said signal to determine the presence and concentration of said target substance.

18. The apparatus of claim 17, wherein said light source is chosen from the group of light sources consisting of lasers, stroboscopes and LEDs.

19. The apparatus of claim 17, wherein said membrane is self-assembled monolayer.

20. The apparatus of claim 17, where said analyzer means is an oscilloscope.